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IS : 1313 - 1984

(Reaffirmed 2003)

Indian Standard

METHOD FOR DETERMINATION OF DIMENSIONAL CHANGES ON WASHING OF KNITTED GOODS CONTAINING WOOL

(*First Revision*)

UDC 677.661 : 677.31 : 677.017.635



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Indian Standard

METHOD FOR DETERMINATION OF DIMENSIONAL CHANGES ON WASHING OF KNITTED GOODS CONTAINING WOOL

(*First Revision*)

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Indian Standard
METHOD FOR
DETERMINATION OF DIMENSIONAL
CHANGES ON WASHING OF KNITTED
GOODS CONTAINING WOOL
(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 23 March 1984, after the draft finalized by the Chemical Methods of Test Sectional Committee had been approved by the Textile Division Council.

0.2 This standard was first published in 1958. It has now been revised in the light of the experience gained during its use. In this revision, the Cubex International Shrinkage Testing Apparatus has been included.

0.3 Knitted goods containing wool change in dimensions when taken off the machine. Subsequently, on soaking in water they change in dimensions a little more due to further relaxation of strains to which they are subjected during manufacturing and if they are subjected to conditions of moisture, pressure, heat and friction, the felting properties of the wool fibre develop and induce further dimensional change. The dimensional change behaviour of the knitted goods is thus of considerable interest to the consumer.

0.4 The range of the conditions to which knitted goods containing wool are subjected is so large that it is not possible for any single test to simulate all of them and hence arbitrary standard procedure is specified in which the severity of felting stage may be adjusted to individual needs.

0.5 The method described in this standard is applicable to knitted fabrics and complete garments containing at least 50 percent wool.

0.6 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

*Rules for rounding off numerical values (revised).

1. SCOPE

1.1 This standard prescribes a method for determination of relaxation dimensional change, felting dimensional change and total dimensional change during washing of knitted goods containing wool. The method is applicable to both fabrics and complete garments.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 3596-1967* and 2.1.1 to 2.1.3 shall apply.

2.1.1 Relaxation Dimensional Change — The increase or decrease in dimensions (length or width or area) that occurs in a fabric or garment after the material is soaked in water and agitated for a short period under prescribed conditions, expressed as a percentage of the corresponding dimension before the treatment.

2.1.2 Felting Dimensional Change — The increase or decrease in dimensions (length or width or area) that occurs in a relaxed fabric or garment after the material is agitated for a certain period under prescribed conditions, expressed as a percentage of the corresponding dimension before the treatment.

2.1.3 Total Dimensional Change — The increase or decrease in dimensions (length or width or area) that occurs in a fabric or garment after it has been subjected to the prescribed conditions of treatment, expressed as a percentage of the corresponding dimension before the treatment.

3. SAMPLING

3.1 Lot — The quantity of the knitted fabric or garments purporting to be of one definite type and quality delivered to a buyer against one despatch note shall constitute a lot.

3.2 Samples for test shall be selected so as to be representative of the lot. Samples drawn in compliance with the material specification or as agreed to between the buyer and the seller shall be held to be representative of the lot.

4. TEST SPECIMENS

4.1 From the samples under test, draw 3 double-thickness test specimens, each being of a size of 300 mm (width direction) × 400 mm (length direction), taking care that:

*Glossary of terms relating to hosiery.

- a) the specimens are not drawn from within 1 m of either end of the piece of fabric,
- b) no two specimens are drawn from the same piece of fabric of garment, and
- c) the specimens are cut and not torn from the piece or garment,

4.1.1 If the test specimens are cut from the garments, avoid areas containing seams, trimmings, etc.

4.1.2 For small articles containing sleeves, the sleeves shall be cut-off or turned inside the garment. When the sleeves are cut-off, the cut parts shall be loosely seamed by the method described in **4.2**.

4.2 The free edges of the double-thickness specimens shall be sewn with a dimensionally stable thread, for example, polyester thread, using a chain stitch and stitch length of 2 to 3 mm.

5. CONDITIONING OF TEST SPECIMENS

5.1 Prior to test, the specimens shall be conditioned to moisture equilibrium from dry side in the standard atmosphere at 65 ± 2 percent relative humidity and $27 \pm 2^\circ\text{C}$ temperature (*see* IS : 6359-1971*).

5.2 When the test specimens have been left in the standard atmosphere for at least 24 hours in such a way as to expose, as far as possible, all portions of the specimens to the atmosphere, they shall be deemed to have reached moisture equilibrium. However, in the case of fabrics which weigh more than 270 g/m^2 , this period shall be 48 hours.

NOTE — It is preferable to store the newly finished fabrics or garments for about a week before conditioning.

5.3 Atmospheric Conditions for Testing — The test shall be carried out in the standard atmosphere (*see* 5.1).

6. APPARATUS

6.1 Cubex International Shrinkage Testing Apparatus or Wash Wheel or an Equivalent Machine — *See* Appendix A.

6.2 A Laboratory or Domestic Spin Drying Apparatus

6.3 Marking Equipment — As specified in 4.3 of IS : 10099-1982†.

*Method for conditioning of textiles.

†Methods for preparation, marking and measuring of fabric specimens and garments in tests for determination of dimensional change.

6.4 Make-Weights — Each make-weight shall consist of two squares of cotton interlock fabric, having a loop length of 2.9 mm and made from 12 tex cotton yarn, sewn together to give a mass of 25 g. The squares shall have rounded corners and have no loose ends or possibility of unravelling. Each make-weight shall be adjusted to a pH of 7 prior to use by soaking it in the liquor specified in 7.2.

7. REAGENTS

7.1 Quality of Reagents — Unless specified otherwise, pure chemicals shall be employed in tests and distilled water (see IS : 1070-1977*) shall be used where the use of water as reagent is intended.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the test results.

7.2 Buffer Solution (pH 7) — A solution containing 4.5 g of anhydrous sodium dihydrogen phosphate plus 8 g of anhydrous disodium hydrogen phosphate per litre, corrected to pH 7. Distilled water is not necessary, but hard water (with total hardness, as calcium carbonate, greater than 100 ppm) shall not be used.

7.3 Wetting Agent

NOTE — Sodium dioctyl-sulpho-succinate is suitable.

8. MARKING AND MEASURING OF TEST SPECIMENS

8.1 The test specimens shall be marked and measured as specified in IS : 10099-1982† (see also Fig. 1).

NOTE — The marks shall not be placed less than 25 mm from the edges of the specimen.

8.1.1 Socks, Stockings — Place the marks (see Fig. 2) so that separate length measurements can be made on the leg and foot of each article. Mark each side of the article. Do not include the heel and the toe sections in the measurements.

8.1.2 Small Articles Other than Socks, Stockings — Place the marks so that the maximum dimensions of length and width can be utilized taking precautions to avoid seams and trimmings.

*Specification for water for general laboratory use (second revision).

†Methods for preparation, marking and measuring of fabric specimens and garments in tests for determination of dimensional change.

9. PROCEDURE

9.1 Initial Measurement

9.1.1 Preconditioning — Expose the specimens to the standard atmosphere as specified in 5.1 until it reaches moisture equilibrium (*see* 5.2). Conduct all measurements in the standard atmosphere.

9.1.2 Lay the specimens flat and remove wrinkles gently, without stretching the specimens. Measures the distance between the centres of each of the pairs of marks to the nearest millimetre (*see* Fig. 1).

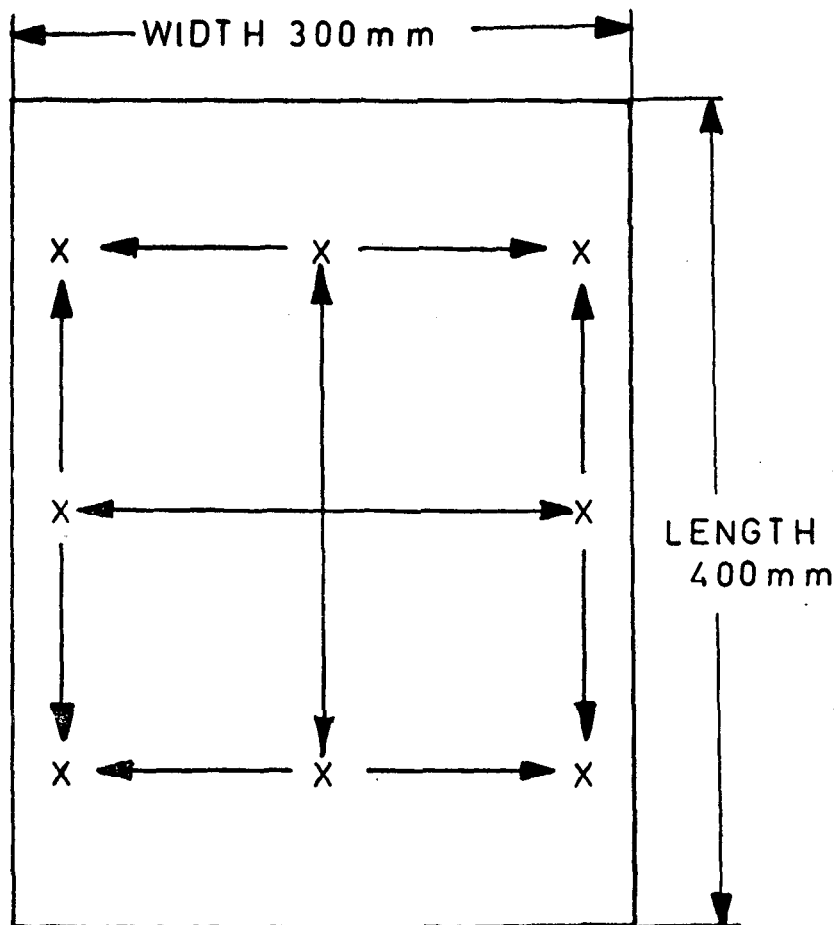


FIG. 1 MEASUREMENT POINTS FOR MARKING THE SPECIMEN

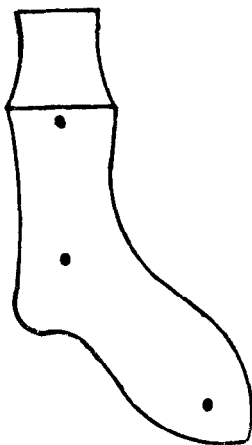


FIG. 2 POINTS FOR MEASUREMENT

9.2 Relaxation Dimensional Change

9.2.1 Run the required volume (see A-1.5 or A-2.6) of the buffer solution containing 0.05 percent (m/v) wetting agents into the machine (see 6.1).

9.2.2 Add a load of mass 1 kg, made up of the test specimens plus make-weights not more than half the load of the specimens.

9.2.3 Ensure that the temperature of the liquor plus load is $40 \pm 2^\circ\text{C}$ at the beginning of the test.

9.2.4 Subject the specimens and make-weights to a static soak of 15 minutes duration, followed by agitation for 5 minutes.

9.2.5 Remove the specimens by folding the corners of each to the centre in such a way that the whole specimen can be supported in hand. Rinse the specimens with as little agitation as possible in three successive baths of clean water at 40°C . While transferring the specimens from one bath to another give one gentle squeeze to remove excess liquor.

9.2.6 Hydroextract the specimens using a laboratory or domestic spin drying apparatus. Fold each specimen as described in 9.2.5 and lay it flat against the side of the drum to avoid stretching during spinning. Continue hydroextraction until no further water is lost.

9.2.7 Dry each specimen by laying it flat on a surface of low frictional characteristics, for example, smooth plastic or metal. Elevated

temperatures may be used if desired, but these should not exceed 55°C. If air flow is employed, the air velocity shall not be so high as to cause agitation of the specimens during drying.

9.2.8 Condition the specimens using the procedure described in 9.1.1.

9.2.9 Measure the specimens using the procedure described in 9.1.2.

9.3 Felting Dimensional Change

9.3.1 Run the required volume (see A-1.5 or A-2.6) of the buffer solution into the machine (see 6.1).

9.3.2 Add a load of mass 1 kg, made up of the test specimens obtained as in 9.2.9 plus make-weights not more than half the load of the specimens. Separate make-weights shall be used for the tests for relaxation and felting dimensional changes.

9.3.3 Ensure that the temperature of the liquor plus load is $40 \pm 2^{\circ}\text{C}$ at the beginning of the test.

9.3.4 Subject the specimens and make-weights to agitation in the machine (see 6.1) for a period of 30 to 60 minutes as agreed between the parties concerned.

9.3.5 Remove the specimens by folding the corners of each to the centre in such a way that the whole specimen can be supported in hand.

9.3.6 Hydroextract the specimens using the procedure described in 9.2.6.

9.3.7 Dry each specimen using the procedure described in 9.2.7.

9.3.8 Condition the specimens using the procedure described in 9.1.1.

9.3.9 Measure the specimen's using the procedure described in 9.1.2.

10. CALCULATION AND EXPRESSION OF RESULTS

10.1 Calculate the mean initial (*I*), relaxed (*R*), and felted (*F*) measurements taking:

- three measurements in each direction for fabrics and garments other than socks and stockings ; and
- two length measurements for socks and stockings, one in leg and the other in foot.

10.2 Determine the linear dimensional change as follows:

$$\text{Relaxation dimensional change, percent} = \frac{R - I}{I} \times 100$$

$$\text{Felting dimensional change, percent} = \frac{F - R}{R} \times 100$$

$$\text{Total dimensional change, percent} = \frac{F - I}{I} \times 100$$

Indicate a decrease in dimension by a minus sign (-) and an increase in dimension by a plus sign (+).

10.3 Determine the area dimensional change as follows:

$$\text{Area dimensional change, percent} = D_w + D_L - \frac{D_w \times D_L}{100}$$

where

D_w = mean dimensional change, percent, in width, and

D_L = mean dimensional change, percent, in length.

11. TEST REPORT

11.1 The test report shall state the following:

- A statement that the test was conducted in accordance with this Indian Standard;
- Type of apparatus used (see 6.1);
- Load to liquor ratio and time of felting stage;
- For socks and stockings, the mean relaxation, felting and total dimensional changes in the length direction only to the nearest 0.1 percent; and
- For fabrics and other garments, the mean relaxation, felting and total dimensional changes in respect of width, length and area to the nearest 0.1 percent.

APPENDIX A

(Clause 6.1)

DETAILS OF WASHING APPARATUS

A-1. CUBEX INTERNATIONAL SHRINKAGE TESTING APPARATUS

A-1.1 The apparatus consists of a stainless steel hollow cube ($368 \times 368 \times 368$ mm inside measurement) having a capacity of 50 litres. The cube is insulated on five sides and the insulation is covered by a metal outer casing. In one face there is an opening fitted with a watertight hinged lid, through which the cube is loaded and discharged. The cube rotates on spindles fixed at diagonally opposite corners, the apparatus being fitted with a reversible drive.

A-1.2 Mounted on the frame is a motor incorporating reduction gearing and an electrically controlled timing device which periodically reverses the motion of the cube. The apparatus is revolved at 60 rev/min for a given time, the direction of rotation being automatically reversed every 5 minutes with a 5-second pause between the reversing cycles. The timing device covers the range of 0 to 60 minutes and automatically cuts off at the end of the pre-set period.

A-1.3 At one corner of the cube is mounted a manually operable drain valve, through which liquid may escape when it is opened by the operator.

A-1.4 An expanded steel guard is provided and is so arranged that when it is lifted to allow the cube to be loaded or discharged, the driving power to the cube is cut off. The whole assembly may be mounted on a rigid steel framework.

A-1.5 The load shall be made up of the test specimens plus make-weights not more than half the load of the specimens. The quantity of liquor used shall be sufficient to cover the load. Normally a load of 1 kg shall be used in 25 litres of the liquor.

A-2. WASH WHEEL

A-2.1 The wash wheel comprises a horizontal cylindrical machine with rotating cage and reversing mechanism. The cage should have a diameter between 400 and 600 mm and peripheral speed of 50 to 55 m/min. Other diameters may also be used provided that the rotational frequency is adjusted to give an equivalent peripheral speed.

A-2.2 Preferably 3 or 4 fins or lifters, about 80 mm wide, equally spaced around the interior of the cage and extending its full length, should be used. A single fin or 2 fins may also be used provided that equivalent results are obtained.

A-2.3 The cage shall turn at such a speed that the load is lifted by the fins and falls back into it. (A peripheral speed of 34 m/min has been found satisfactory). The cage shall make 5 to 10 revolutions before its direction of rotation is reversed.

A-2.4 The machine shall be equipped with a heating facility using live steam, gas or electricity, and an outlet large enough to permit discharge of all liquid from the machine in less than 2 minutes.

A-2.5 A thermometer in a suitable well, or an equivalent equipment, shall be provided to indicate the temperature of water within 1°C during washing and rinsing, and there shall be an outside water gauge to indicate the level of water in the wash wheel.

A-2.6 The mass of the load to be run in the machine shall be between 8 and 50 kg of air-dry fabric per cubic metre of cage space, including the volume of the fins. The load shall be made up of the test specimens plus make-weights not more than half the load of the specimens. The quantity of liquor used shall be sufficient to cover the load, the level being situated at a height from one-seventh to one-third of the inside diameter of the cage.

(Continued from page 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	$1 \text{ N} = 1 \text{ kg.m/s}^2$
Energy	joule	J	$1 \text{ J} = 1 \text{ N.m}$
Power	watt	W	$1 \text{ W} = 1 \text{ J/s}$
Flux	weber	Wb	$1 \text{ Wb} = 1 \text{ V.s}$
Flux density	tesla	T	$1 \text{ T} = 1 \text{ Wb/m}^2$
Frequency	hertz	Hz	$1 \text{ Hz} = 1 \text{ c/s (s}^{-1}\text{)}$
Electric conductance	siemens	S	$1 \text{ S} = 1 \text{ A/V}$
Electromotive force	volt	V	$1 \text{ V} = 1 \text{ W/A}$
Pressure, stress	pascal	Pa	$1 \text{ Pa} = 1 \text{ N/m}^2$



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